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or John T. King -*

**COAL**

AND ITS



PRODUCTS.



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# COAL AND ITS PRODUCTS.

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Coal is the mainspring of civilization; by it the wheels of industry are put in motion and commerce carried on all over the globe. By coal night is converted into day, and winter into summer; it is the embodiment of a power more potent than that of fabled genii and giants.

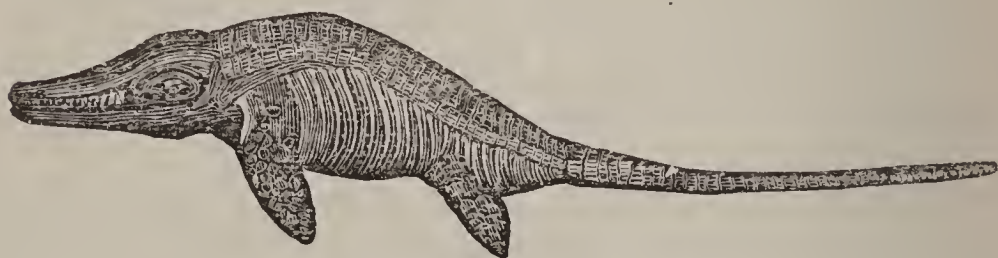
It once composed the tissues of those strange trees that lifted their sealed trunks and waved their feathery foliage along the marshy shores of the carboniferous continent, which no human foot had ever trod, but swarmed with gigantic salamanders, and mail-clad fishes that were the monarchs of the lonely lakes and seas. So far as man existed, the earth was Azoic, and this fact teaches the wisdom and goodness of Him who hath in so wonderful a manner, and in such inexhaustible quantity stored up in so imperishable a form for uncreated man the fuel of a world for ages incalculable by man.

The Chinese knew of and used coal centuries ago, and in the reign of Edward VI., 1552, coal was used in France.

The earliest notice we find of Stone Coal is B. C. 371. In 1240 coal was first sent to London. In 1398 Edward I. published a proclamation against it as a public nuisance.

Carbon or coal is one of the chief constituents of this vast and varied universe. It constitutes a large percentage of all vegetable, animal and mineral masses. When one sees in the bowels of the earth masses of hard black coal or contemplates it in the glowing grate or furnace, he can scarcely realize that he is looking upon a substance whose formation dates back millions of ages before the human family existed. It was previous to and during the period of the coal formation

that the reptilian monsters swarmed and reigned supreme over both sea and land, huge reptilian whales mounted on paddles swarmed in and were the tyrants of the Atlantic sea, and the great Ichthyosaurus layed his colossal form in the ancient sea and lacustrine waters, and the terrible and monstrous Plesiosaurus, held undisputed sway in the vast aqueous domain of an ancient globe, and waged a deadly strife with contemporaneous monsters of the deep.



(ICTHYOSAURUS).

If man had been permitted to view the spectacle of these countless numbers of ancient leviathans and terrible serpents of the sea and the equally countless numbers of the land mammoths, powerful Dinotheria, Megatheria, Mylodons and Glyptodons, engaged either in sportive pastime or deadly combat, with a sea ensanguined and convulsed, and the earth trembling under their ponderous tread, he would have been appalled, even if he had been the most intrepid mariner that ever strode the deck of barque in ancient or modern seas, but when they existed and held their sway, it was long,—countless ages ere man appeared in Eden, or in any portion of the earth—long before the prow of ship cleaved these waters, or canvas was spread to waft the commerce of civilized nations.

At the period of the coal formation, upon the land roamed in countless numbers, inconceivable by man, the unwieldy Dinotherium, corporeally gigantic, with his elephantine proboscis and downward curved dual tusks, that served as implements, or huge pickaxes to uproot the deeply-imbedded roots of ancient jungles and forests of the stately Leipodendron, Equisetæ and Calamite.

Contemporaneous was the Mammoth, gigantic and

countless in numbers as were the huge *Megatherium* and *Mylodon*, a climbing, herbivorous, gigantic animal of the character of the "Sloth," a fossil specimen of which may be viewed and studied in the Smithsonian Institute, Washington, and in primæval morasses, jungles and tarns, ponderously stalked the sluggish, mail-clad, armored, huge, canopied "*Glyptodon*," whose fossil remains can also be seen in the department of Paleontology of the Smithsonian Institute, Washington.



(PLESIOSAURUS.)

Contemporaneous with these huge marine monsters and gigantic quadrupedal animals of the land were the great reptilian birds, the formidable *Dinosaurus*, *Pterodactyl* and *Archeopteryx*, that in mammoth measure stalked intrepidly and strode the shore sands of these ancient lakes and seas.

It is within the recollection of at present living persons, when coal was first used upon this continent as fuel. One hundred and ten years ago, the existence of anthracite was first known to the white settlers of Pennsylvania, but, in 1684, twenty years after Colonel John Campbell laid off the first town lots of Pittsburg, privilege was granted by the Penns to mine coal from the hill opposite the city. The privilege being granted for \$30 sterling per lot; one hundred years elapsed, 1784, before coal mining began in the vicinity of Pittsburg. In 1791, the Maunch Chunck mines were discovered,

and soon after, the Lehigh mines. In 1806, a load of coal was sent to Philadelphia, and upon trial was considered unmanageable; for a long time there was positive prejudice against anthracite, and it was during the war of 1812 that the "Black Stones," as it was called, began to be used in stoves for warming houses, but so little was



(GLYPTODON).

thought of it as fuel that only 24 tons of it were used in the year 1824, in the city of Philadelphia, and in the six following years only 365 tons had been used in that city.

Anthracite coal was discovered in Rhode Island in 1768 but the coal was not used to any extent until 1808.

Coal is the production of vegetable matters which grew upon the place or locality where it is now found, and the process by which it was and is now being converted from woody matter into coal is mainly accounted for by two causes—moisture and pressure. New Castle coal was used as fuel more than 800 years ago and there is no doubt that the ancient Romans and Britons used it.

That coal is a production of vegetation there can be no doubt and a most wonderful vegetation it was, and how interesting are the gigantic plants, trees and forests of an ancient world that now produce the fuel that blazes on every hearth-stone and that cheers and gladdens every happy home, you can see in every coal-mine wonders of nature that charm and fascinate and awe with their sublimity; here are found impressions

of leaves in their most delicate tracery and the stems and trunks of trees of gigantic size now extinct upon the earth, and as one roams through these subterranean passages and galleries of the coal measures, you can see in the roof or rocks vast quantities of the prostrate and flattened trunks of trees of gigantic size and length, of unknown species. This coal vegetation was of a description compared with which anything in our day of the same class of vegetation in respect to size and quantity fades into insignificance; the exuberant growth of our tropical climates is as but the grass of the fields as compared with that of the coal era; for example, the *equisetæ* or horse-tail flags that now grow upon the



### ARCHEOPTERYX.

earth measure not more than one-half inch in diameter, while those that grew at the period of the formation of the coal measures were as much as fourteen inches. Club-mosses even in our tropics are dwarfs, while those of the coal measures were as thick as a man's body and sixty and seventy feet in height. A large portion of the vegetation of the coal era is composed of ferns of incredible size; measuring sixty feet in height, and there

we find the stately *Leipodendron* and ornate *Sigillaria* the impression upon the bark of which reminds one of the sculptor's art, as distinctly impressed as if made by a seal upon wax by the hand of man.



Sea weeds and other marine plants are not found in coal, the plants are all of fresh water species. The formation of coal is a demonstrable fact. We can see the woody fibre transformed into a dark combustible compound that we call peat or lignite. This lignite is formed in nearly all the states and territories between the Missouri River, and the Pacific coast or more than half the territory of the United States. The principal localities where it is found of the best quality is along the lines of the lower Pacific and Kansas Pacific Railroad. We then see it hardening both by compression and by

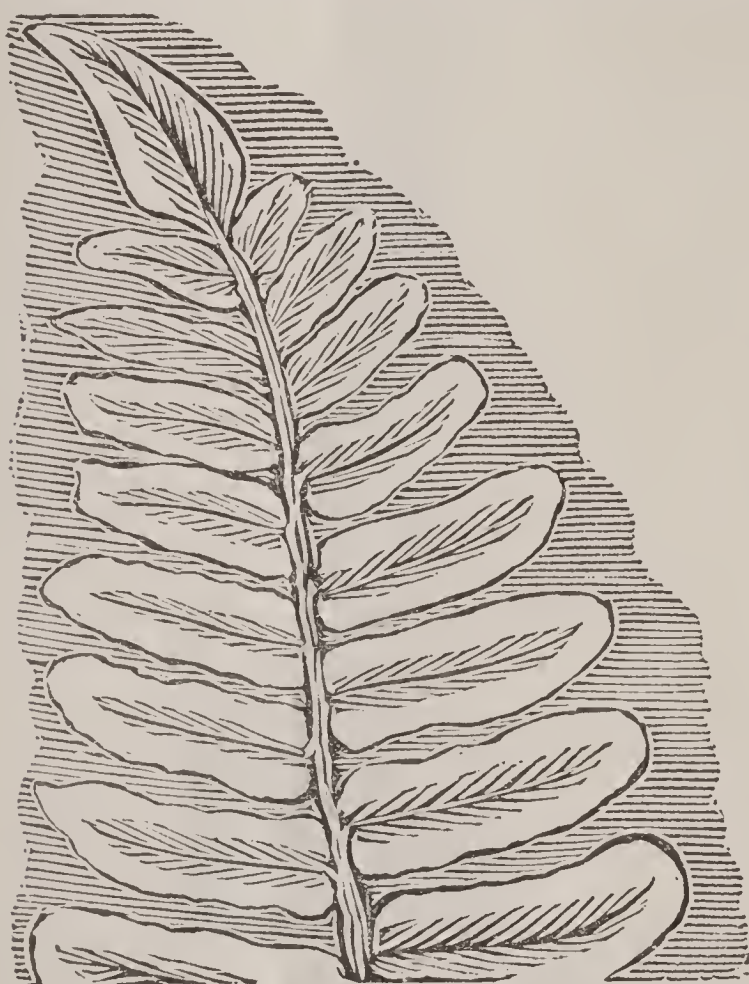


### FOSSIL FERN OF THE COAL MEASURES.

the slow burning process in water known as *ecemacausis*.

But how was this vast amount of vegetable matter accumulated, from whence did it come? At the period of the coal formations vast and endless forests of gigantic trees and mammoth ferns covered the earth's entire surface, quickened and stimulated into growth by a fervent sun and an unceasing almost impenetrable veil of

moisture. The debris of these endless forests and boundless morasses of luxuriant ferns successively falling year by year through countless eons of ages were preserved against decomposition by stagnant water and dense atmospheric humidity and in time became peat and subsequently coal. The formation of different kinds of coal such as anthracite and bituminous with all their varieties is due to the different degrees of progress made in the process of liquefaction and carbonization. The chemist can convert vegetable matter into coal of all degrees of hardness, possessing all the vari-



STIGMARIA FLORA OF THE COAL MEASURES.

ous qualities of that formed by nature, and is able to demonstrate that all coal when first formed or in its first stage of carbonization is of the bituminous variety and that anthracite is the result of igneous action to which it was subjected after it became coal ; as proof of

the fact anthracite coal is only found in metamorphic rocks and the only coal formed in this character of rock is anthracite.

As before stated in peat and lignite we see the first step in the formation of coal. Peat is bituminous vegetation, generally mosses and other herbaceous plants which have accumulated in marshes called peat-bogs; lignite is the product of a similar alteration or metamorphosis effected in the woody tissue and from retaining to a greater or less degree the form and structure of



### SIGILLARIA FLORA OF THE COAL MEASURES.

wood receives the name of lignite. Peat is a formation of the present period, lignite is of an older formation, and bituminous coal of a still older metamorphosis, and where special causes and favorable conditions such as the requisite amount of heat prevailed to carry the transformation of the peat or bituminous coal a step or

stage further, anthracite was produced, and when this transformation was carried on yet further the coal was converted into Plumbago or black lead.

Under peculiar circumstances nature has departed from her usual routine, has directly changed the lignite into anthracite,—has ignored the intermediate stage, the bituminous, as may be seen near Santa Fe, New Mexico and on Queen Charlotte's Island, south of Alaska.

If we assume that the average forests of the present period requires 100 years to attain its full growth, it would require 7,400 years to accumulate the mass of coal existing in the 30 feet coal beds of Pennsylvania.

The thickness of a seam of coal depends on the length of time the vegetable materials of which it was composed were accumulating, and the fragmentary or detached character of the coal fields is undoubtedly caused by convulsions which took place long subsequent to the formation of the coal beds. Thus have deep valleys been formed dividing the coal field in measure, leaving sometimes only small patches of coal upon the tops of mountains and often a wide area of country interposes between the fragments of the same coal measures. That the great upheaval of vast mountain ranges was long subsequent to the coal formations requires no argument to convince one. Upon the loftiest peaks are to be found the coal measures or beds, their strata undulating conformably with similar strata on distant apices or the escarpment of the fracture of the bed will be upon the mountain side and the corresponding portion deep down in the valley and often separated by miles of intervening country.

Of the thirty-seven states composing the Union, the following contain no coal of any kind whatever: Maine, New Hampshire, Vermont, Connecticut, New York, New Jersey, Delaware, South Carolina, Florida, Mississippi, Louisiana, Wisconsin and Minnesota, several others not named above contain a little coal but it is of no commercial value.

There are four great carboniferous coal fields in the United States, the first and most important is the Appalachian or Alleghany, it is 875 miles in length, travers-

ing parts of seven States in a northeast and southwest direction, and from 30 to 180 miles in width.

The second great coal field occupies the centre part of the State of Michigan.

The third great coal field is of enormous dimensions covering two-thirds of the large State of Illinois, the western part of Indiana and the western part of Kentucky.

The fourth great coal field covers a large portion of Iowa, an extensive area in Missouri, and a portion of Kansas and Nebraska. Another extensive coal deposit exists in Nova Scotia and New Brunswick. The area of the United States is 2,915,203 square miles and the coal area covers one square mile in 10. The entire area of the coal fields of the United States is 58,000 square miles, viz: Pennsylvania, 12,774; Maryland, 550; Ohio, 10,000; West Virginia, 16,000; Kentucky, 8,983; Tennessee, 5,100; Alabama, 5,330, averaging 50,000,000 tons annually.

As previously stated the varieties of coal are the Anthracite, Bituminous, Lignite and Peat.

#### COAL PRODUCING COUNTRIES OF THE GLOBE.

Belgium.....	900	Square Miles
Prussia.....	1,800	" "
Austria.....	1,800	" "
France.....	1,800	" "
Spain.....	3,000	" "
England.....	11,000	" "
Nova Scotia.....	18,000	" "
Chili, Australia, India and China, each....	28,000	" "
United States.....	192,000	" "

It is the manifest destiny of America to be the greatest coal producing country of the world. Pennsylvania annually mines on an average 20,000,000 tons of Anthracite and 15,000,000 tons of Bituminous coal, or 35,000,000 tons, and Maryland's annual production is on an average 1,650,000 of tons of Bituminous and Semi-Bituminous coals.

#### Receipts of Coal at Baltimore for the past three years.

Years.	Cumberland, tons.	Anthracite, tons.
1878.....	1,087,685	301,042
1877.....	966,668	343,936
1876.....	1,141,689	263,954

Anthracite is by far the most important, it is the hard coal of America. It is the universal fuel for domestic use in the Eastern and Middle States in preference to all other kinds of fuel, it is also called "glance or blind coal or culm" in England. It largely consists of carbon, from 85 to 93 per cent., its color is jet black, the hardest kinds metallic black. It has a bright, glossy lustre and a beautiful iridescent lustre, it is harder to kindle than other kinds of coal, has great heating power and never leaves coke and but few ashes, it does not soil the hands and from its cleanliness, the absence of smoke, soot and dirt is universally preferred for domestic use. Its existence was first made known to the white settlers of Pennsylvania in 1768. It would be difficult to make people believe that all the anthracite or hard coal of America of which more than 22,000,000 tons are annually mined, comes from a small locality in the State of Pennsylvania, from the four counties of Dauphin, Northumberland, Schuylkill, Carbon and Luzerne, that in its area if joined together would only form a small county 20 miles in width by 24 miles in length.

The great coal fields of Pennsylvania are the Schuylkill, 73 miles in length by a mean breadth of 2 miles. The Shamokin and Mahoonoy, 25 miles in length by 3 in width, and the Lehigh coal field consisting of 7 separate basins.

The Wyoming and Lackawanna is the largest and finest of the anthracite coal basins, it is a solid unbroken field of more than 50 miles in length with an average breadth of 5 miles and contains 198 square miles, it is situated wholly in the county of Luzerne and is completely shut in by mountain barriers called the Shawnee and Wyoming mountains. The total area of the anthracite coal region of Pennsylvania is 472 square miles.

The coal seams are found as thin as a sheet of paper and of all thicknesses up to the gigantic beds on the Lehigh mountains some of which are more than 50 feet in thickness. The bituminous coal seams are usually from 3 to 6 feet in thickness, at Pittsburg they are 8 feet, and at Cumberland, Md., they are 14 feet, and in Ohio 12 feet in thickness.

## WORKABLE SEAMS OF COAL.

The late report of the English Royal Commission included all coal seams workable 1 foot in thickness, seams of good coal 22 inches in thickness have been worked in Pennsylvania. Miners call from 2 to 3 feet of clean coal a workable seam.



MINING COAL.

The thickness of the coal is not in itself conclusive as to the quantity that can be produced in any given area, a 3 feet seam will produce 4,840 tons to the acre

of land, or every cubic yard of coal is equal to 1 ton, but the 4,840 square yards of an acre can not be entirely mined. In the Blossburg, Pennsylvania, mines nearly every particle of coal can be mined, on the other hand in the Cumberland, Maryland region where the coal is 14 feet thick, only from 7 to 9 feet of coal can be taken out owing to the softness of the coal and the difficulty of supporting the roof of the mine.

In the anthracite region the amount of minable coal is small in comparison to the whole quantity in the ground, and 3 separate seams of 6 feet each are more profitable than 1 of 18 feet of thickness. The loss attending the breaking up of hard coal is 15 to 40 per cent. These facts indicate the small proportion of marketable coal to that deposited in the earth. The waste therefore in mines and above ground in the proportion of coal for market is immense.

The mining of anthracite coal is done chiefly by blasting, that of bituminous coal by cutting beneath the coal seam and along the sides of the chamber as far as the miner can reach with his pike, then by driving wedges along the top the mass of coal is thrown down. Powder is also occasionally used.

As before stated all kinds of coal must concede to anthracite for household use, on account of its cleanliness, freedom from smoke, soot and flame.

### BITUMINOUS COAL.

By the term bituminous coal is meant coal that contains more largely than anthracite the gases, oxygen, hydrogen and nitrogen, and they give it a more flaming character in burning; it burns like bituminous, but contains no true bitumen. It is the coke forming coal.

### SEMI-BITUMINOUS COAL

Is the kind which yields *coke* and combustible gases, and not less than 70 nor more than 84 per cent. of carbon; it is decidedly dirty, cannot be touched without soiling the hands; it is the great gas-coal and the best for blacksmithing and steam generating purposes. The great bituminous and semi-bituminous coal regions are the Blossburg, McIntire, Towanda, Antrim, Johns-

town and Broad Top in the State of Pennsylvania, and the Cumberland, Frostbury or George's Creek coal mines in Alleghany county, Maryland.

The Cumberland coal region is one of the most important of the bituminous coal regions of America. The coal has a world-wide fame as an iron-making and steam-producing coal. Every ocean steamer uses it, except those of the United States navy which all burn anthracite on account of the absence of smoke which would betray their vicinity in the day to an enemy.

In the Cumberland coal bed, the coal is fourteen feet in thickness, the thickest of any in America. It is thirty miles in length, and between four and five miles in width or twenty-seven square miles. Twenty-three square miles of this region has not been mined, and, upon reasonable data, the calculation has been made that the universal area of 23 square miles can yield 75,703,410 tons of coal, and will take thirty-three years to exhaust. Of this incalculably valuable area, the Consolidated Coal Company is proprietor of more than one-half of the entire Cumberland coal field. The Consolidation Coal Company owns the Cumberland and Pennsylvania and the Cumberland Branch lateral Railroads. The balance of the coal area belongs to fourteen other companies.

The true bituminous coals are eminently preferable for gas manufacture, for blacksmithing, puddling, fires in rolling mills and for generating steam. Its value is due to its great heating power and the facility of diffusing the flame that accompanies its combustion over a large surface, and for its coke-producing qualities.

### GEORGE'S CREEK MINES

Embrace the Consolidated, George's C. C. & I. Co., Maryland, New Central, American, Hampshire and Baltimore, Borden, Atlantic and George's Creek. The latter property comprises some hundreds of acres, it produces coal of a superior quality, justly popular for locomotives, is largely used on the Pacific coast for blacksmithing and welding. Franklin, Swanton, Potomac, Piedmont C. & I. Co., and Blæen Avon.

The lands of the New Central Coal Company are located in the heart of the region, and comprise between three and four thousand acres, on which openings have been already made, developing 1,100 acres of the fourteen feet bed, the coal from which has proved itself to be the very best in the Cumberland region. The facilities of the Company are among the best, and their rank as producers is shown in the fact that for three years past they have sold and delivered an average of 325,000 tons each year.

At Bloomington, 2 miles west of Piedmont, on the Baltimore & Ohio Railroad, are the elegant mines of the Hampshire & Baltimore Coal Company, also on the C. & P. Road, one mile from Piedmont and two miles from Lonaconing are the other mines of the company. At Colt's Armory, in Hartford, and at the U. S. Armory, at Springfield, it has been found after the most thorough tests that the coal from the Cumberland or Alleghany region is the best and most economical coal known, for heat or steam generating purposes.

The Hampshire Company's mines are located on the celebrated fourteen foot bed of this coal region; their annual product shows that they take front rank with the producers, and the markets secured by the Company (to the West Indies, South America and the Canadian Provinces), furnish evidence of its quality and efficiency.

Sold by the cargo, and shipped to BALTIMORE and ALEXANDRIA, the Hampshire coal is specially adapted to the manufacture of IRON, and is unsurpassed for SMITH'S USE, LOCOMOTIVES, and for Steam purposes generally.

### CANNEL COAL.

Is a beautiful grate coal. It contains more illuminating gas than bituminous coal, and when added to the latter improves the quality of the gas. It produces but little coke.

### BLOCK COAL.

The State of Indiana is the chief producer of Block Coal. It is chiefly used in the "raw" state for smelting iron.

Grahamite was chiefly used by gaslight companies for improving the gas; it is remarkably free from sulphur and ash, and produces excellent coke, in photometric value it is equal to 32 candles.

### ASPHALTUM.

Asphalt is a natural mineral bitumen, and is composed of asphaltene and petroleum. In nature it is found combined with carbonate of lime and other mineral substances. It fuses only at about 400 degrees Fahrenheit, and maintains its hardness under a constant heat of 150 degrees Fahrenheit. This substance was formerly obtained almost solely from the neighborhood of the Dead Sea, but within five years, the great lake of asphalt in the Island of Trinidad has been used as a source of supply both for the United States and Europe. This lake is one of the most remarkable natural curiosities in the world, and its existence has never been satisfactorily explained. It is circular in shape, and covers about 114 acres. Its depth is unknown, although it is estimated to be 800 feet.

The asphaltum constantly bubbles up in the centre, and flows outward. On the outer edges it hardens, and it will sustain carts and teams 200 or 300 feet from the shore. It is cut out in blocks, refined by heat, and finds its way to market molded into barrels. For paving city streets, asphalt is fast coming into general use in Europe. In Paris, all the boulevards and other principal streets are paved with it, and in London no other material is now allowed to be used for laying purposes.

### COMBUSTION OF COAL.

There is scarcely anything that is so much wasted as fuel. Every other mode of obtaining power has proved to be more costly than the use of steam from the combustion of coal and the improvements of the methods of using it so as to obtain a greater degree of power from the fuel used is therefore one of the most important subjects which can engage the attention of a manufacturing and commercial people.

The burning of coal is strictly a chemical process. It is the chemical union of the oxygen of the air with the carbon of the coal accompanied with light and heat. Coal consists of carbon and hydrogen. They are its only valuable constituents, it contains others but they are of no value; in its combustion a definite amount of oxygen must be furnished for a definite quantity of hydrogen, and for a fixed quantity of carbon. Here there are those elements for the production of heat. Two of them carbon and hydrogen cost money, while nature freely furnishes the oxygen, yet strange to say, there is scarcely a coal fire where a large portion of the two expensive elements are not wasted for the want of the sufficient supply of the third "oxygen" which costs nothing. Great improvements have been made in lamps for the proper admission of air, thus improving combustion. The same should be done for the stove. When the draft of a stove or furnace is closed or when the fire is covered with ashes the fire is said to be smothered. For carbon and hydrogen to be combustible, air should be freely furnished, all these elements should be brought together in exactly the proper proportions. If the supply of oxygen is insufficient the combustion is imperfect and consequently a great loss of heat or a great waste of the heating power of the fuel. Neither the carbon and hydrogen of the coal and the oxygen of the air unite readily in mass, if they did an open coal fire would be preferable. They only unite by atoms or particle by particle in definite proportions.

When fresh coal is thrown upon a fire the temperature decreases and if under a boiler the steam goes down for the reason that the freshly added coal absorbs a given amount of caloric or heat to bring it up to the point of combustion.

The common kerosene and argand lamp gives more light than a candle because the air and carbon and hydrogen of the oil unite particle by particle. This should be the case with a stove, grate or furnace, the air should be introduced in small jets or quantities. When perfect combustion takes place there will be no soot or smoke produced; if too much or too little air is supplied, soot and smoke will result. In all furnaces and

stoves heat is lost by opening the doors and putting on fresh coal.

### PETROLEUM OR MINERAL OIL.

What is petroleum or mineral oil? It is like coal, slow maceration of plants, with this difference, in the formation of coal the plants which entered into its composition were woody or fibrous. The plants which concurred to the formation of Petroleum were sea weeds or marine plants. They have no wood in their tissue. It is exclusively cellular and the pure bitumen has been preserved in subterranean cavities. The conditions favorable to an exuberance of vegetation existed long before the carboniferous epochs and the result was an immense marine vegetation, and vast reservoirs of coal oil.

This Petroleum or Rock Oil is found in many parts of the world. Job saw rivers of oil flowing from the rocks. It was known more than 2,000 years ago to the Greeks and Romans. For centuries the coal oil wells and springs of India have supplied the inhabitants with illuminating oil. The same oil is used by the dwellers upon the borders of the Caspian Sea and the entire population of Persia. For more than 200 years Italy has used coal oil, and it is found in many islands of the sea. Cuba and Trinidad produce it.

Analysis shows that Rock Oil is nearly identical with the fluids distilled from bituminous coal. In the United States Petroleum is found in great profusion in Pennsylvania, New York, Ohio, Virginia and Kentucky. Rock Oil was known from a remote period to the Indians, who used it for medicinal purposes. Under the names of Genesee Oil and Seneca Oil it was for a long time, and yet is, a popular and efficacious remedy for rheumatism. Previous to 1845 no attempt was made to procure oil in any quantity and what was produced was used almost entirely for medicinal purposes. In 1845 the great oil fever broke out and the excitement resulting from it is fresh in the memory of many. In 1860 more than 200 wells were sunk in the vicinity of Oil Creek. Immense fortunes were made and lost. Oil refineries sprang up in every city and such a gigantic industry did it become

that from the exportation of one and one-half millions of gallons in 1860, in 1868 it had reached ninety-nine millions of gallons, and in 1870 the export was one hundred and forty-one millions gallons.

The aggregate receipts of Refined and Crude at Baltimore for the past year was 879,605 barrels, against 1,094,952 barrels in 1877. Of this decrease 206,936 barrels were per the B. & O. road, and 8,411 per the Northern Central. The total exports of petroleum from the United States for the year amount to 325 millions of gallons, against 331 millions in 1877. New York fell off compared with the previous year about 12 millions; Baltimore upwards of 7 millions, whilst Philadelphia shows a gain of 26 millions.

Coal or carbon as is well known is the producer of our illuminating gas. It is within the recollection of present living persons when gas was first used. When not quite sixty years ago it was determined to light the streets of London with gas, it was looked upon as Utopian, even by scientific men, even including the famous chemist, Sir Humphrey Davy, and a few years later when the Houses of Parliament were about to be lighted by gas, the members were so perturbed on account of the supposed intense heat that the gas pipes would be subjected to, that they insisted upon having them laid several feet distant from the walls of the building, so as to prevent any injury to the building. The City of Baltimore was the first city on the American continent lighted by gas.

#### VOLUME OF GAS OBTAINED FROM A TON.

CUBIC FEET.

Cannel.....	15,000
Cumberland.....	10,000
English, <i>mean</i> .....	11,000
Newcastle.....	10,000
Kilkenny.....	12,500
Oil and Grease.....	23,000
Pine Wood.....	11,800
Pittsburgh Coal.....	9,520
Resin.....	15,600
Scotch Coal.....	15,000
Virginia Coal.....	8,936

Coal is the producer of yet another set of most important and valuable substances or products. Previous to being in a condition for illuminating purposes gas is deprived of a variety of so-called impurities. The most important of these is Coal Tar. This substance, so repulsive in odor, and defiling to the touch, was for a long time totally unprofitable, and was considered a nuisance by gas companies, has now arisen to the highest commercial and artistic importance on account of those valuable unrivalled and astonishingly beautiful colors or dyes it yields, known as Analine, Anthracene and Alazarine.

These magnificent dyes have influenced and directed the fashion and taste of the entire globe, and have supplanted one of the most ancient, fast and important colors heretofore known, and have had an effect upon agriculture and the revenue of two continents. The Madder plant once so widely cultivated for its coloring and cultivated for centuries as a source of national wealth for several nations has had to yield to the brilliant and gorgeous dyes of the repulsive coal tar of the gas house. In these brilliant dyes obtained from the nauseous coal tar we see petrified, enshrined and preserved countless ages before man's creation, the virgin, most brilliant and resplendent rays of a newly created sun. In them we behold the brilliant sunbeams that fell upon an unpeopled world, that were wholly absorbed by the endless forests and rank vegetation that at that period was earth's universal garniture.

## THE MECHANICAL EQUIVALENT OF HEAT.

1. The quantity of heat produced by the friction of bodies, whether solid or liquid, is always proportional to the quantity of force expended. 2. The quantity of heat capable of increasing the temperature of a pound of water 1 degree Fahrenheit, requires for its evolution the expenditure of a mechanical force required by the fall of 772 pounds through the space of one foot.

The quantity of heat which would raise one pound of water one degree in temperature is exactly equal to what would be generated if a pound-weight, after

having fallen 772 feet, had its moving force destroyed by collision with the earth. Conversely, the amount of heat necessary to raise a pound of water one degree would, if applied mechanically, be competent to raise a pound-weight 772 feet high, or it would raise 772 pounds one foot high.

### UNDERGROUND TEMPERATURE.

The depths and corresponding temperatures are as follows:

Depth in feet.	Degrees Fahr.	Depth in feet.	Degrees Fahr.
68	47.9	1290	58.4
299	48.8	1414	59.4
621	50.7	1652	61.4
939	57.8	1900	64.1

### DEEPEST COAL PIT.


The deepest pit in the world is said to be at Chatelineau, Belgium. It is 2822 feet deep from the surface, and it was intended to sink another shaft in a tunnel from the bottom of the first shaft, a further depth of 492 feet, making a total depth of 3314 feet. The deepest coal shaft in England is the Dunkenfield, 2,060 feet, took ten years time to sink, cost \$500,000, and this to reach a bed of coal only 4 feet 8½ inches thick.

**QUARLES & CO.**

**COMMISSION**

**Lumber Merchants,**

CORNER

East Falls  Eastern Avenues,

**BALTIMORE.**

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NOTICE. — White Pine, Hemlock, Walnut, Ash, Cherry, Beech, &c., and all kinds of Lumber handled on Commission, and prompt returns made.

**Advances on Consignments.**